CLAIMS

1. Method for introducing in continuous a substance in liquid phase into plastics granules comprising the steps of:

a) feeding a substantially continuous flow of said plastics granules to at least one substantially static spraying chamber (40, 29),

b) spraying said substance in liquid phase onto the plastics granules continuously flowing within said spraying chamber (40, 29),

c) passing the granules partially or totally coated by said substance in liquid phase continuously leaving the spraying chamber (40, 29), through substantially static mixing means (6) supported in at least one mixing chamber (5a, 5b) provided downstream of said spraying chamber (40, 29), so as to submit said granules to mixing,

d) submitting the mixed granules so obtained to drying for a time sufficient to allow a substantially complete absorption of the substance in liquid phase by the granules.

2. Method according to claim 1, characterized in that said drying step is carried out in a drying chamber (70) provided downstream of said mixing zone (5).

3. Method according to claim 2, characterized in that the plastics granules flow by gravity in a substantially continuous manner through said spraying (40, 29), mixing (5a, 5b) and drying (70) chambers.

4. Method according to claim 1, characterized in that said spraying step of the substance in liquid phase is carried out by means of a plurality of injectors (11, 21, 34)

supported within said spraying chamber (40, 29).

5. Method according to claims 1 or 4, characterized in that said spraying step is carried out by nebulizing said substance in liquid phase in a plurality of droplets having a mean diameter comprised between 10 and 500 μm.

6. Method according to claim 4, characterized in that said spraying step is carried out by means of said injectors (11, 21, 34) by intermittently injecting the substance in liquid phase at an injection frequency comprised between 500 and 2000 strikes/min and at an injection pressure comprised between 100 and 300 bar.

7. Method according to claims 1 or 4, characterized in that it further comprises the step of splitting the continuous flow of plastics granules in a plurality of streams continuously flowing in respective flowpaths defined within the spraying chamber (40, 29) facing each of said injectors (11, 21, 34).

8. Method according to claim 1, characterized in that said steps a) - d) are carried out at a temperature comprised between the melting temperature of the substance in liquid phase and the minimum temperature between the softening temperature of the polymer to be impregnated and the temperature at which the substance in liquid phase starts to thermally deteriorate.

9. Method according to claim 1, characterized in that said spraying b) and mixing c) steps are carried out in a total time comprised between 10 and 40 minutes and that said drying step d) is carried out in a time comprised between 30 and 90 minutes.

10. Method according to claim 1, characterized in that said step c) of mixing the granules is carried out by passing the granules partially or totally coated by said substance in liquid phase through a static mixer (37) comprising a

substantially pyramidal central body (38) supported by a plurality of supporting legs (39) at a predetermined distance from an inner wall (41) of said mixing chamber (5a, 5b); and a plurality of baffles (49), extending between said inner wall (41) and respective openings (42) for the flow of the granules defined between said supporting legs (39), said mixer being adapted to deviate the granules flowing in the central zone of said mixing chamber (5a, 5b) towards the peripheral zone thereof and the granules flowing in the peripheral zone of the mixing chamber (5a, 5b) towards the central zone thereof.

11. Method according to claims 1 or 10, characterized in that said step c) of mixing the granules is carried out by passing the granules partially or totally coated by said substance in liquid phase through substantially static mixing means (6) comprising a plurality of mixing bars (46).

12. Method according to claim 11, characterized in that said step c) of mixing the granules is carried out by passing the granules partially or totally coated by said substance in liquid phase through at least two superimposed groups of mixing bars (46) arranged substantially perpendicularly with one other.

SUB A2 > 13. Method according to anyone of the preceding claims, characterized in that it further comprises the step of submitting the granules leaving the drying chamber (70) to a soaking step in order to equalize the distribution of said substance in liquid phase into each of the plastics granules.

14. Method according to claim 1, characterized in that the granules are made of a plastics selected from the group comprising: polyethylene, ethylene-propylene copolymers, ethylene-propylene-diene terpolymers, ethylene-vinyl acetate (EVA) copolymers, acrylic polyesters including

ethylene-methyl acrylate, ethylene-ethyl acrylate, ethylene- butyl acrylate groups, and mixture thereof.

15. Method according to claim 1, characterized in that said substance in liquid phase is a substance selected from the group comprising: cross-linking agents, cross-linking co-agents, thermal stabilizers, light stabilizers, voltage stabilizers, UV stabilizers, processing aids, lubricants, flame retardants, plasticizers, nucleating agent, additives for water-treeing resistance, and mixtures thereof.

16. Apparatus (1) for introducing in continuous a substance in liquid phase into plastics granules, comprising a supporting structure adapted to support in series and in substantial vertical alignment:

- a feeding section (2) of the plastics granules provided with means (3) for feeding in a substantially continuous manner said granules to at least one spraying chamber (40, 29) provided with means (10) for spraying said substance in liquid phase onto the plastics granules,

- at least one mixing chamber (5a, 5b) of the plastics granules partially or totally coated with said substance comprising substantially static mixing means (6) supported in said mixing chamber (5a, 5b),

- at least one drying chamber (70) adapted to receive a predetermined amount of the plastics granules coated with said substance in liquid phase.

17. Apparatus (1) according to claim 16, characterized in that the means (3) for feeding in a substantially continuous manner said granules comprises at least a dosing valve (8) supported downstream of a storage tank (9) of the granules.

18. Apparatus (1) according to claim 16, characterized in that the means (10) for spraying the substance in liquid

phase comprises at least one injector (11) having a nozzle (12) supported within said at least one spraying chamber (40), said injector (11) forming an angle (α) comprised between 90° and 45° with a longitudinal axis of the spraying chamber (40).

19. Apparatus (1) according to claim 16, characterized in that the means (10) for spraying the substance in liquid phase comprises at least one injector (11, 21, 35) having a nozzle (12, 35) supported within said at least one spraying chamber (40, 29), said injector (11, 21, 34) extending parallel to a longitudinal axis of the spraying chamber (40, 29).

20. Apparatus (1) according to claim 19, characterized in that said injector (21) is supported within said at least one spraying chamber (40).

21. Apparatus (1) according to claims 18 or 19, characterized in that the means (10) for spraying the substance in liquid phase comprises a plurality of injectors (11, 21, 34) angularly offset from one another.

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22. Apparatus (1) according to claim 21, characterized in that said at least one spraying chamber (40) further comprises a shaped insert (13, 19) adapted to define in said chamber respective flowpaths of the granules facing each of said injectors (11, 21).

23. Apparatus (1) according to claims 18 and 22, characterized in that said flowpaths are defined in respective open channels (14), axially formed in said insert (13), said injector (11) being oriented in such a way as to spray the substance in liquid phase into said channels in countercurrent to the continuous flow of the granules.

24. Apparatus (1) according to claims 19, 20 and 22, characterized in that said flowpaths are defined in

respective closed channels (20), axially formed in said insert (19), said injector (21) being oriented in such a way as to spray the substance in liquid phase into said channels in countercurrent to the continuous flow of the granules.

25. Apparatus (1) according to claim 24, characterized in that said channels comprise opposite frustoconical end portions (22, 23).

26. Apparatus (1) according to claim 19, characterized in that it comprises a plurality of spraying chambers (29), arranged in parallel with one another, defined in respective ducts (30) extending between said feeding section (2) and said mixing chamber (5a, 5b) of the granules.

27. Apparatus (1) according to claim 26, characterized in that said ducts (30) comprise a first portion (31) forming an angle (β) comprised between 30° and 60° with the longitudinal axis of the apparatus (1), a second portion (32) substantially parallel to the longitudinal axis of the apparatus (1) and a third portion (33) forming an angle (γ) comprised between 30° and 60° with the longitudinal axis of the apparatus (1), and in that said spraying chambers (29) are defined in said second portion (32).

28. Apparatus (1) according to claim 27, characterized in that it comprises a plurality of injectors (34), each having respective nozzle (35) co-axially supported within said spraying chambers (29).

29. Apparatus (1) according to claim 28, characterized in that said injectors (34) are oriented in such a way as to spray the substance in liquid phase cocurrently with the continuous flow of the granules.

30. Apparatus (1) according to claim 16, characterized in that said substantially static mixing means (6) comprises

at least one static mixer (37),

31. Apparatus (1) according to claim 30, characterized in that said at least one static mixer (37) comprises a substantially pyramidal central body (38) having respective faces (44), said central body (38) being provided with a plurality of deviating wings (43) projecting from each of said faces (44) and being supported by a plurality of supporting legs (39) at a predetermined distance from an inner wall (41) of said mixing chamber (5a, 5b), and a plurality of baffles (49) extending between said inner wall (41) and respective apertures (42) for the flow of the granules defined between said supporting legs (39).

32. Apparatus (1) according to claim 16, characterized in that said substantially static mixing means (6) comprises a plurality of mixing bars (46).

33. Impregnating apparatus (1) according to claim 32, characterized in that said substantially static mixing means (6) comprises at least two superimposed groups of mixing bars (46) arranged substantially perpendicularly with one other.

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